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DESCRIPTIVE AND CONSUMER PREFERENCE OF *OMASHIKWA*, TRADITIONAL FERMENTED BUTTERMILK FROM NAMIBIA

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ABSTRACT

Omashikwa, traditional fermented buttermilk processed by the Owambo and Herero communities from the North and Central Namibia has become very popular among the local consumers. However, its sensory quality fluctuates from one household to the next due to poor hygiene, sanitation and the non-standardized traditional processing technologies. The raw milk from indigenous cows is fermented traditionally in calabashes without the addition of known starter cultures. Milk in the calabash is then stored in a warm place in the house for two to three days to ferment. Once it is fermented, it is shaken or agitated in the calabash for hours to churn into butter. Butter granules are removed and either made into butter or boiled to make Ghee or butter oil known as *Omazeothung'ombe* by the Herero community and the remaining liquid is the fermented buttermilk or *Omashikwa*, Consumers of *Omashikwa* have been complaining about its sensory quality fluctuations. The Department of Food Science and Technology of the University of Namibia took the initiative of finding out its problems by subjecting it to sensory evaluation in order to improve its quality. The sensory properties of two samples of fermented buttermilk (*Omashikwa)*; the traditional and laboratory processed *Omashikwa* were investigated by descriptive and consumer preference analyses for improvement. Eight trained panelists using a 5-point hedonic scale were used to investigate the descriptive sensory characteristics of *Omashikwa*, while 45 consumers familiar with *Omashikwa*, determined the preference product of their choice. The results for traditional *Omashikwa* (TO) were compared to the laboratory made *Omashikwa* (LO). The descriptive attributes scores on the levels of syneresis 3.4 (2.9), filth 3.0 (1.8), rancidity 3.4 (1.8) and bitterness 4.2 (2.5), and were significantly higher for traditional omashikwa than LO. Aroma 2.6 (4.2), viscosity 2.5 (3.8) and texture 2.7 (4.2) were lower in traditional *Omashikwa* and this may explain the 80% consumer preference compared to the laboratory made *Omashikwa*. The application of good manufacturing practices (GMPs) on unit operations, particularly filtration and heat treatment of milk prior to fermentation and Hazard Analysis Critical Control Point (HACCP) contributed significantly to the improvement and perceived sensory characteristic differences that exist between the traditional and laboratory made *Omashikwa.*

Key words: Descriptive, Preference, fermentation, buttermilk, *Omashukwa*

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INTRODUCTION

Rural women in Namibia and in other parts of Africa rely on agriculture for household food security and income generation in order to sustain family livelihood. However, besides agricultural produce, value added traditional fermented milk products are used to provide nutrition, create jobs and generate income for general livelihood and food security [1]. Fermented milks are known to be stable, have long shelf life and are known to be healthier than fresh milk [2]. In addition, fermented milks have probiotic properties, cosmetic value, assist in controlling pathogenic and spoilage microorganisms, reduce lactose intolerance to sensitive consumers, provide a variety of foods and can preserve better [3].

Omashikwa,, a traditionally fermented buttermilk in Namibia, is a popular rural milk product processed in Central and Northern Namibia by the Herero and Owambo communities. Processing of *Omashikwa,* is based on household traditional technology as described by Bille *et al.* [4,5] and is processed for the purpose of quenching thirst, as a condiment for use with other food stuff, for creating employment and for income generation. However, due to inconsistency of its quality, consumers tend to be selective for preference when purchasing *Omashikwa* in the open market.

The problems of traditionally fermented milk products in the rural areas of developing countries have been investigated and they include lack of consistent technology, problems of hygiene, sanitation, short shelf life, syneresis, variable sensory qualities and unattractive presentation to the consumers [2]. Knowing the sensory characteristics of traditionally fermented milks among competitors, is a key priority in producing quality product for business [2,6]. The finding presents the ideal knowledge as it provides detailed information, reliable and consistent results for processing of competitive product for the competitive market [2,7].

The study is designed to compare the descriptive and consumer preference characteristics of traditional and laboratory made *Omashikwa* in order to assess the quality of the products and to design methods for improvement and commercialization.

MATERIALS AND METHODS

Fresh raw milk, *Omashikwa* and *Omukunzi* samples

Nine samples of raw milk, *Omashikwa* (fermented buttermilk) and *Omukunzi* (*Boscia albitrunca*) root were obtained from Neudamm dairy farm in Windhoek, Namibia and from the villages in Northern Namibia. Raw milk samples were used to produce traditional and laboratory *Omashikwa* for descriptive and preference sensory evaluation. The samples of traditional *Omashikwa* were used as starter cultures (back slopping) and were collected in 250 ml sterile screw-capped bottles and transported in a cool box at 5-7^{o}C to Neudamm Agricultural Campus Laboratory cold room of the University of Namibia in Windhoek. Similarly, raw fresh milk samples were collected in 10 lt sterile plastic containers and transported as above to the cold room for experimentation.

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Processing of traditional *Omashikwa*

Five liters of raw milk was processed as described by Bille *et al.* [4,5]. Raw milk was placed in a plastic container; temperature was maintained at 25ºC in a water bath and inoculated with 2% *Omashikwa* culture (back slopping). At the same time 4 pieces of *Omukunzi (Boscia albitrunca)* root (approx. 2 cm^2 each) were added per 5 lt milk and allowed to ferment to a pH of 4.5 for 3 days (72h). The sour milk was then agitated by manual shaking until butter separated out, scooped off and washed to remove buttermilk. The remaining milk after churning is the buttermilk or *Omashikwa.* Samples were taken at this stage for descriptive sensory analysis and consumer's preference.

Processing of laboratory *Omashikwa*

Laboratory *Omashikwa* was processed using traditional methods but applying good manufacturing practices to all unit operations. Milk was filtered, pasteurized at 85ºC for 30 min and cooled to inoculation temperature of 25ºC in ice water-bath, inoculated with 2% *Omashikwa* cultures (back slopping) with the addition of *Omukunzi* root and fermented as above. When a pH of 4.5 was reached, cream was scooped off, instead of churning into butter as in the traditional method. The remaining fermented milk (*Omashikwa)* was gently stirred to mix. Samples were taken at this stage for descriptive sensory analyses and consumer's preference.

Descriptive Sensory Analysis

Descriptive sensory analysis was performed by a panel of 8 trained panelists and who were familiar with *Omashikwa* [6,7,8]. Panelists were extensively trained for 14 sessions on the development and use of attributes and scales to describe fermented buttermilk (*Omashikwa).* Attributes evaluated were: viscosity, syneresis, filthiness aroma, rancidity, flavor, and bitterness. Definitions for each of these attributes are given in Figure 1. Samples were presented to the panelists in individual, three-digit-coded polystyrene containers (50 ml) in a water bath with ice to keep the *Omashikwa* temperatures low and uniform during testing. The *Omashikwa* temperature during testing was 7±1ºC and evaluation was done on a 3 day old *Omashikwa* that was kept under refrigeration after the incubation period. Testing was conducted under fluorescent illuminated room light conditions. Each panelist evaluated both samples of the *Omashikwa* in triplicate at a rate of one session per sample set, conducted over three days. The panel evaluated forty eight samples in total. On each test day samples were presented in a coded three digit cups and served at a randomized order. Evaluations were made using a 5-point line scale anchored for each of the tested attributes.

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Figure 1: Sensory descriptors and definitions for attributes of *Omashikwa*

Sensory attributes	Definitions
Viscosity	Resistant to flow, holding together, thickness.
Syneresis	Separation of liquid serum on the surface of a product or jel.
Filthiness	Presence of dirt materials, foreign bodies in the product like insects, splinters, grass and hair in the product.
Aroma	Smell, odour of the products by sniffing, pleasant, noticeable product smell.
Rancidity	Spoiled fat/oil products with soapy taste, hydrolyzed fats and oils with disagreeable taste.
Flavour	Sensations comprising olfactory, taste or combination of senses that give overall taste.
Bitterness	Stringent in the mouth, sharp unpleasant, painful sensation of sharp taste like quinine.

Consumer preference test

Consumer preference evaluation was conducted by a panel of 45 consumers familiar with *Omashikwa,* and consisted of students and staff from Neudamm Campus, Faculty of Agriculture and Natural Resources of the University of Namibia. The consumer panelists were served with samples in cups with 3 digit coded numbers in a randomized order and were asked to choose and indicate which of the two *Omashikwa* samples they preferred based on their tastes and observations.

STATISTICAL ANALYSIS

All analyses were done in triplicate and repeated three times. Data were analyzed by calculating mean and standard deviation. Samples of traditional and laboratory *Omashikwa* were analyzed by Quantitative Descriptive Sensory Analysis [9,10,11]. A *t*-test (SPSS Ver. 14) was used to test the sensory quality differences between the traditional and laboratory fermented *Omashikwa*. Significance was accepted at $p < 0.05$.

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RESULTS

Mean scores for descriptive sensory analysis

The mean score results for descriptive sensory evaluation of *Omashikwa* are shown in Table 1. The attributes of LO (TO in brackets) for viscosity was 3.8 (2.5), syneresis was 2.9 (3.4), filth 1.8 (3.0), aroma 4.2 (2.6), rancidity 2.6 (4.5), acidity was 4.1 (3.2) and bitterness was 2.5 (4.2) and they differed significantly ($p>0.05$) in both the traditional and laboratory *Omashikwa* samples.

Consumer Preference results

The consumer preference ranking results (Table 2) showed that LO was more acceptable by 36 out of 45 panelist (80%) due to its mild acid taste, low rancid flavor, mild bitterness, low syneresis and low filth compared to TO. Therefore the overall preference was given to LO with 80% of the consumers preferring laboratory made *Omashikwa* (Table 3). This was based on higher intensity of aroma, flavor and thickness or higher viscosity. Other attributes namely, syneresis, filth, rancidity, acidity and bitterness had very low perception in laboratory made *Omashikwa.* Heat treatment and controlled fermentation processes created good environment for production of preferred aromatic flavours in laboratory made *Omashikwa* from citrate such as diacetyl, acetoin and acetate [12,13].

DISCUSSION

The traditional *Omashikw*a had higher scores for filth, syneresis, rancidity and bitterness. The high level of filth is due to the unhygienic and insanitary conditions in the production of milk in the rural setup [5]. In addition, the milk was not filtered during processing of traditional *Omashikwa* compared to the milk used for the production of laboratory *Omashikwa*. The higher level of syneresis may be due to the wild microorganisms found in raw milk which may produce gasses or rennet-like enzymes causing wheying off and make the curds to float including back-slopping contamination with traditional *Omashikwa* cultures [2,5] . The churning process of unpasteurized *Omashikwa* may be the reason for the rancid flavour in traditional *Omashikwa* as compared to the laboratory *Omashikwa.* The presence of lipase enzyme in the traditional *Omashikwa* may have hydrolyzed the membrane-free fats globules during churning [5].

In the laboratory made *Omashikwa*, the lipase enzymes were inactivated during milk pasteurization to cause any flavour defects. In addition, cream was scooped off from the laboratory made *Omashikwa* instead of churning. Hence, the fat globule membrane remained intact [5]. The high bitter flavour perceived in the traditional *Omashikwa* may be due to the presence of wild microorganisms and enzymes which may hydrolyze fats and proteins into bitter fatty acids such as butyric, caproic, caprylic, capric and lauric acids and bitter peptides like tryptophan and tyrosine [14,15,16].

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The insignificant difference was probably due to the use of unpasteurized milk in TO containing microorganisms and enzymes. However, consumer preference analysis showed preference for laboratory *Omashikwa*. Despite the good contribution of *B. albitrunca* root to traditional *Omashikwa,* it is still crucial that the use of GMPs and HACCP on unit operations and the use of proper starter culture in the processing of traditional fermented milks are recommended to be followed across the continent in order to be competitive in the market.

The consumer preference for laboratory made *Omashikwa* may have been attributed to good manufacturing practices on unit operations, particularly heat treatment on k-casein of milk prior to processing and controlled fermentation [17,18,19]. These unit operation processes may have contributed to these quality attributes as 39 consumer panelists out of 45 of the age group ranging from 19-39 years (or 80%) preferred laboratory made *Omashikwa.* Only 20% of the consumers (or 9 consumers) of the aged between 40 and 58 years preferred traditional *Omashikwa* (Table 3). Heat treatment of milk tends to denature whey proteins and during fermentation, casein micelles combine with denatured whey proteins to form a product with ability to absorb more water causing higher viscosity. This process tends to be preferred by consumers as it thickens the product and improves its mouth feel as described by Walstra and Jenness [18] and Dannenberg and Kessler [19].

CONCLUSION

This study showed that the attributes of syneresis, filth, rancidity and bitterness contributed to the differences between the traditional and laboratory made *Omashikwa.* This was probably due to the good manufacturing practices on unit operations which were carried out on laboratory made *Omashikwa*. Most of the other attributes namely aroma, flavor and viscosity were not significantly different, although higher scores were given to laboratory *Omashikwa.*

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Table 1: Mean scores for descriptive sensory attributes of *Omashikwa* panel

Sensory attributes	Traditional *Omashikwa*	Laboratory *Omashikwa*
Viscosity	2.50±0.71[a]	3.80±0.79[a]
Syneresis	3.40±0.70[a]	2.90±1.29[b]
Filth	3.00±1.05[a]	1.80±1.03[b]
Aroma	2.60±0.70[a]	4.20±0.42[a]
Rancid	4.50±0.72[a]	2.60±0.68[b]
Acid Taste	3.20±0.79[a]	4.10±0.74[a]
Bitterness	4.20±0.79[a]	2.50±0.71[b]

Scores were obtained with a structural scale ranging from 1 – 5. Mean scores with different superscripts on the same row were significantly different ($p<0.05$).

Table 2: Consumer preference results

Products:	**Attributes**						
	Overall Acceptability	**Acid**	**Rancid**	**Bitter**	**Viscosity**	**Syneresis**	**Filth**
TO	2.3	4.5	3.6	4.4	2.5	4.2	3.9
LO	4.6	2.6	2.0	2.6	3.9	2.9	1.8

Key: 1=dislike extremely; 5=like extremely on a hedonic scale. TO=traditional *Omashikwa* and LO=Laboratory *Omashikwa*

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Table 3: Percentage of consumer preference between traditional and laboratory *Omashikwa* samples.

Age group	Panelists	TO	LO	%
1	36	Disliked	Preferred	80
2	9	Preferred	Disliked	20

Key: N=45; Group 1=19-39 Yrs; 2=40-58 Yrs; 36 Preferred LO and 9 Preferred TO in the preference test.

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